

Attendance Problems.**Complete each statement.**

1. A _____ is a three-sided polygon.

2. A _____ is a four-sided polygon.

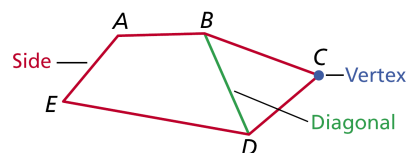
Evaluate each expression for $n = 6$.3. $(n - 4)12$ 4. $(n - 3)90$ **5. Solve for a:** $12a + 4a + 9a = 10$

- I can classify polygons based on their sides and angles.
- I can find and use the measures of interior and exterior angles of polygons.

Vocabulary		
side of a polygon	vertex of a polygon	diagonal
regular polygon	concave	convex

Common Core CC.9-12.G.CO.11 Prove theorems about parallelograms.

Each segment that forms a polygon is a **side of the polygon**. The common endpoint of two sides is a **vertex of the polygon**. A segment that connects any two nonconsecutive vertices is a **diagonal**.



You can name a polygon by the number of its sides. The table shows the names of some common polygons.

Number of Sides	Name of Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
12	Dodecagon
n	n -gon

Remember!

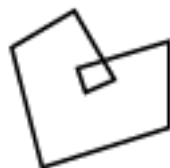
A polygon is a closed plane figure formed by three or more segments that intersect only at their endpoints.

Video Example 1. Tell whether each figure is a polygon. If it is a polygon, name it by the number of its sides.

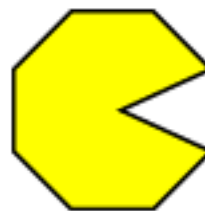
A.



B.



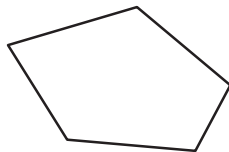
C.



1 Identifying Polygons

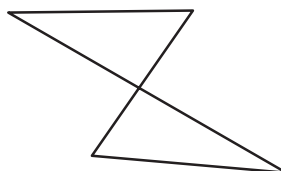
Tell whether each figure is a polygon. If it is a polygon, name it by the number of its sides.

A



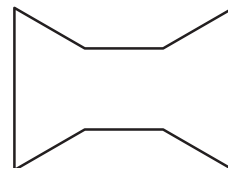
polygon, pentagon

B



not a polygon

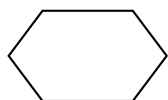
C



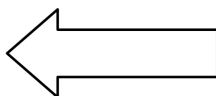
polygon, octagon

Example 1. Tell whether each figure is a polygon. If it is a polygon, name it by the number of its sides.

A.



B.

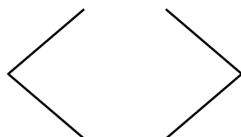


C.

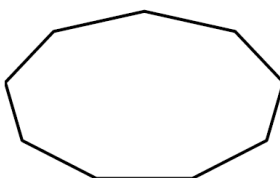


Guided Practice. Tell whether each figure is a polygon. If it is a polygon, name it by the number of its sides.

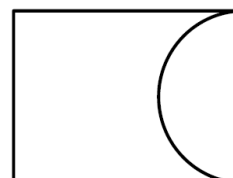
10.



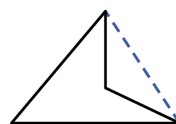
11.



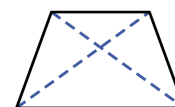
12.



All the sides are congruent in an equilateral polygon. All the angles are congruent in an equiangular polygon. A **regular polygon** is one that is both equilateral and equiangular. If a polygon is not regular, it is called irregular.



Concave
quadrilateral

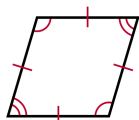


Convex
quadrilateral

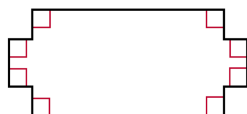
A polygon is **concave** if any part of a diagonal contains points in the exterior of the polygon. If no diagonal contains points in the exterior, then the polygon is **convex**. A regular polygon is always convex.

Video Example 2. Tell whether the polygon is regular. Tell whether it is concave or convex.

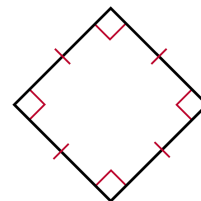
A.



B.

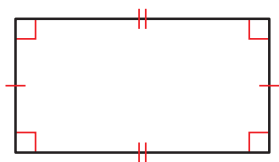


C.

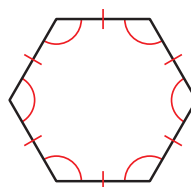
**2**

Classifying Polygons

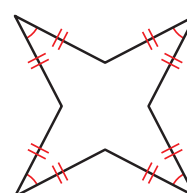
Tell whether each polygon is regular or irregular. Tell whether it is concave or convex.

A

irregular, convex

B

regular, convex

C

irregular, concave

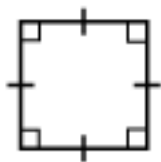
Q: What type of figure is like a lost parrot?

A: A polygon!

"Wish not to seem, but to be, the best." -- *Aeschylus*

Example 2. Tell whether the polygon is regular. Tell whether it is concave or convex.

A.



B.

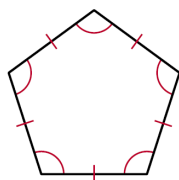


C.

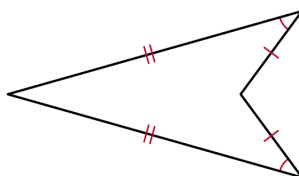


Guided Practice. Tell whether the polygon is regular. Tell whether it is concave or convex.

13.



14.



Remember!

By the Triangle Sum Theorem, the sum of the interior angle measures of a triangle is 180° .

Complete the table.

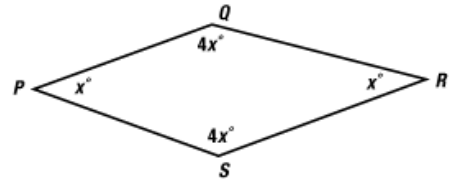
Polygon	Number of sides	Number of triangles (formed by the diagonals from one vertex)	Sum of Interior Angle Measures	Each angle measure if the polygon is regular.
Triangle				
Quadrilateral				
Pentagon				
Hexagon				
Octagon				
Decagon				
n-gon				

Video Example 3.

A. Find the sum of the interior angle measures of a convex hexagon.

B. Find the measure of each interior angle of a regular octagon.

C. Find the measure of each interior angle of quadrilateral PQRS.



Remember!

An exterior angle is formed by one side of a polygon and the extension of a consecutive side.

Theorem 6-1-2 Polygon Exterior Angle Sum Theorem

The sum of the exterior angle measures, one angle at each vertex, of a convex polygon is 360° .

3 Finding Interior Angle Measures and Sums in Polygons

- A** Find the sum of the interior angle measures of a convex octagon.

$$(n - 2)180^\circ \quad \text{Polygon } \angle \text{ Sum Thm.}$$

$$(8 - 2)180^\circ \quad \text{An octagon has 8 sides, so substitute 8 for } n.$$

$$1080^\circ \quad \text{Simplify.}$$

- B** Find the measure of each interior angle of a regular nonagon.

Step 1 Find the sum of the interior angle measures.

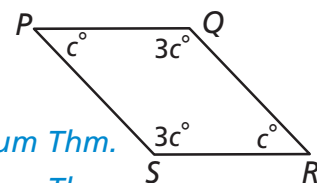
$$(n - 2)180^\circ \quad \text{Polygon } \angle \text{ Sum Thm.}$$

$$(9 - 2)180^\circ = 1260^\circ \quad \text{Substitute 9 for } n \text{ and simplify.}$$

Step 2 Find the measure of one interior angle.

$$\frac{1260^\circ}{9} = 140^\circ \quad \text{The int. } \angle \text{ are } \cong, \text{ so divide by 9.}$$

- C** Find the measure of each interior angle of quadrilateral $PQRS$.



$$(4 - 2)180^\circ = 360^\circ \quad \text{Polygon } \angle \text{ Sum Thm.}$$

$$m\angle P + m\angle Q + m\angle R + m\angle S = 360^\circ \quad \text{Polygon } \angle \text{ Sum Thm.}$$

$$c + 3c + c + 3c = 360 \quad \text{Substitute.}$$

$$8c = 360 \quad \text{Combine like terms.}$$

$$c = 45 \quad \text{Divide both sides by 8.}$$

$$m\angle P = m\angle R = 45^\circ$$

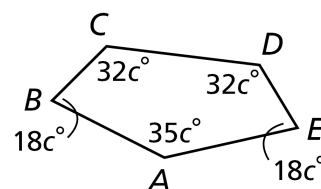
$$m\angle Q = m\angle S = 3(45^\circ) = 135^\circ$$

Example 3.

- A.** Find the sum of the interior angle measures of a convex heptagon.

B. Find the measure of each interior angle of a regular 16-gon.

C. Find the measure of each interior angle of pentagon $ABCDE$.



15. Guided Practice. Find the sum of the interior angle measures of a convex 15-gon.

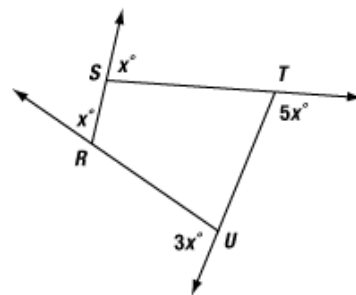
6-1 Properties and Attributes of Polygons (p 399) 17, 18, 19, 21, 23-24.



Video Example 4.

A. Find the measure of each exterior angle of a regular hexagon.

B. Find the value of x in polygon RSTU.



4 Finding Exterior Angle Measures in Polygons

A Find the measure of each exterior angle of a regular hexagon.

A hexagon has 6 sides and 6 vertices.

sum of ext. \angle s = 360°

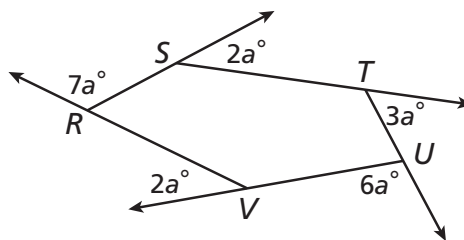
measure of one ext. $\angle = \frac{360^\circ}{6} = 60^\circ$

Polygon Ext. \angle Sum Thm.

A regular hexagon has $6 \cong$ ext. \angle s, so divide the sum by 6.

The measure of each exterior angle of a regular hexagon is 60° .

B Find the value of a in polygon RSTUV.



$$7a^\circ + 2a^\circ + 3a^\circ + 6a^\circ + 2a^\circ = 360^\circ$$

$$20a = 360$$

$$a = 18$$

Polygon Ext. \angle Sum Thm.

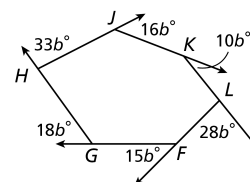
Combine like terms.

Divide both sides by 20.

Example 4.

A. Find the measure of each exterior angle of a regular 20-gon.

B. Find the value of b in polygon $FGHJKL$.

**Guided Practice**

16. Find the measure of each exterior angle of a regular dodecagon.

17. Find the value of r in polygon $JKLM$.

